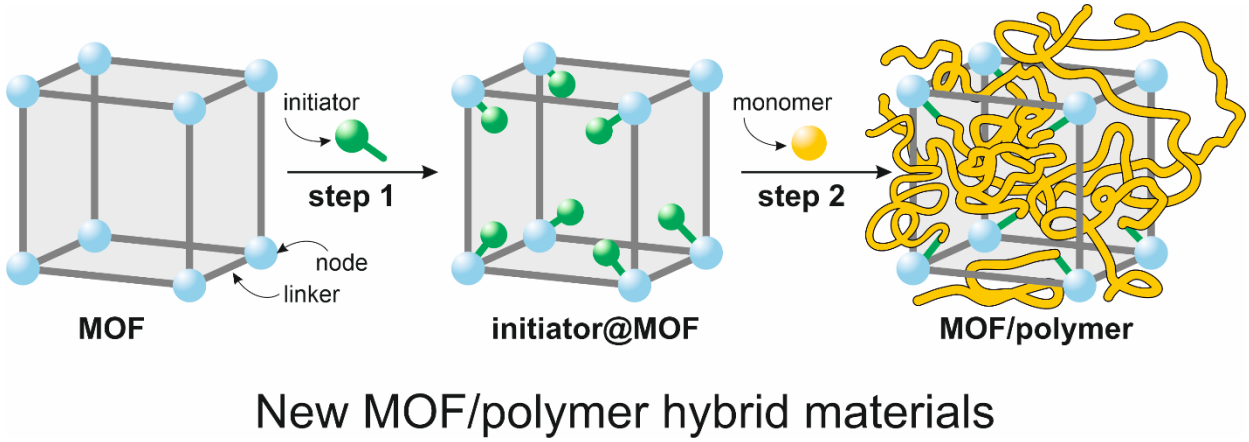
Free Radical Polymerization in Metal-Organic Frameworks - towards New MOF/Polymer Hybrids

Effectively combining different types of materials with very different properties is a challenge for modern materials chemistry. Scientists are constantly working on creating new composite or hybrid materials with unique properties.

Metal-Organic Frameworks (MOFs) are fascinating **porous coordination polymers** whose structure resembles porous sponges. These ordered structures containing huge voids have found various applications, e.g., in gas storage, separation, catalysis, biomedicine and others. There is virtually an unlimited possibility of creating new MOF structures, thanks to the possibility of combining their building blocks (inorganic clusters and organic linkers) into an almost infinite number of connections, which allows us to design the structure and function of these materials for specific applications. Unfortunately, a huge barrier to the wide application of MOF materials is their low processability. To improve these MOF properties, it is proposed to use **MOF/polymer hybrid materials**, as organic polymers have excellent processability, stretchability and chemical resistance.



In this project, an original strategy for obtaining **MOF/polymer hybrids** will be developed, which allows for permanent binding of an organic polymer directly to the MOF material. The main goal of this project is to investigate the possibility of creating new multifunctional MOF/polymer hybrid materials using a porous material as a macroinitiator in free radical polymerization. In the first stage of the research, the functionalization of building elements of selected porous coordination polymers will be carried out to introduce radical polymerization initiator molecules into their structure. Materials prepared in this way will then be used to conduct polymerization initiated directly in the pores of the MOF network. An integral part of this research will be to investigate the possibility of controlling the length of the emerging polymer chains.

The original MOF/polymer hybrids obtained during this project will be tested for the capture of greenhouse gases (carbon dioxide), hydrocarbon vapors and volatile organic compounds, separation of difficult-to-separate mixtures (e.g., alkane isomers with the same number of carbon atoms or aromatic hydrocarbon mixtures). We will also explore the possibility of incorporating catalytic functions into MOF/polymer hybrid materials to obtain effective catalysts for the neutralization of toxic organophosphorus compounds.